

Yi 2
7397
F 4

Animal heat continued.

of Respiration —	156.
of Coughing —	174.
— Sneezing —	175
— Yawning	176
— Laughter	177
— Crying —	178
— Voice & Speech	179

✓ ~~Q~~ I object to it, because we often
find the skin cold, ^{while the blood} ~~but with a full~~
~~and natural pulse flows as usual~~
thro the blood vessels, & we also find

the skin warm while the pulse is
~~D^r De Haen found it perfectly natural in a~~
~~weak or imperceptible. Now if heat~~
~~power in an artery in which there is a total stop-~~
Depends on the friction of the blood
~~upon the circulation of the blood~~
against the blood vessels, it would be

in some ratio to the force or weakness
of its circulation. — Indeed this is
so far from being the case, that a limb
when deprived of its principal artery
by the operation for the aneurism
is often ^{warm} ~~warmer~~ after the loss of the
artery than it was before. — D^r De Haen
lets us be found a paralytic arm ^{cold} in w^{ch}
the pulse was natural.

by their action upon each other ~~by~~
 2^d ~~I~~ object to this ^{theory} hypothesis, that the
 blood does not move with sufficient
 Velocity thro' the Arteries to produce that
 degree of heat which we perceive in the
 body. But Dr Martin who defends
 this ^{theory} hypothesis, - says that the increase
 of Surface in the Arteries compensates
 for the diminution of Velocity in the
 blood. But allowing the diminution
 of the vessels to be equal & proportioned
 to the diminution in the Velocity
 in the small vessels, yet still the Dr's
^{theory} ~~theory~~ hypothesis may be overthrown
 by the following ~~Observations~~ facts.
 viz. that in vessels of the same size
 near the heart, & in the remotest

IV & I object to it because the heat of a
limb which is deprived of its principal
Artery is ~~often~~ greater after the loss
of the Artery than it was before.]

has suggested a 4th cause of animal heat. He
IV. # Dr Cullen supposed the heat of the body
to be the effect of its vitality, & ascribed it
to what he called a vital principle which
he supposed to be seated principally in the
nervous system. As we do not admit the
existence of a vital principle I cannot of
course admit of ~~any~~ Dr Cullen's ^{theory} hypothesis
of the cause of ~~the~~ animal heat.

All these theories have yielded to
one first suggested by Dr Black, and

extremities, the blood moves with
very different velocities, and yet not-
withstanding this, we find the heat of
the ~~body~~ ^{exactly} nearly the same in
every part of the ~~body~~. body. ~~the~~

^{Explanation}
a third hypothesis which has been
proposed to account for animal heat is,
that it depends upon the action of the
different particles of blood upon each
other in the blood vessels. A single exp.
will refute this opinion. Water, or
quicksilver if agitated every even
so long in a vial never produces a
single particle of heat. The collision
of the particles of the quicksilver
is certainly ^{much} ~~is~~ greater than y.
collision of the blood of any blood vessels. ~~the~~

extended, and improved by the labors
of many ingenious Chemists. I
shall briefly give you a detail of the

^{mention}
I shall first ~~derive~~ ^{mention} this theory with
all the facts on which this theory is
founded, and then mention the objections
to it, and endeavour afterwards

to reconcile — facts & arguments
which ~~are~~ it is founded, and then
shall
then mention ~~some~~ a number of
endeavour to answer the objections.
that have been made to it. to it.

~~It belongs to Chemistry to~~
~~have suggested the only rational~~
~~theory of the ^{that has been proposed,} caloric heat, and to~~
~~the illustrious Dr Black to have led~~
~~the way in these inquiries, and~~
~~exp^s which have ^{conducted us} led to this theory.~~

In order to explain this theory, it will
 be necessary to ^{remark} ~~show~~ that there are various
 modes of existing heat. The only one that
 I shall consider is, by means of combustion.
tion such as goes forward in a ordinary
 fire.

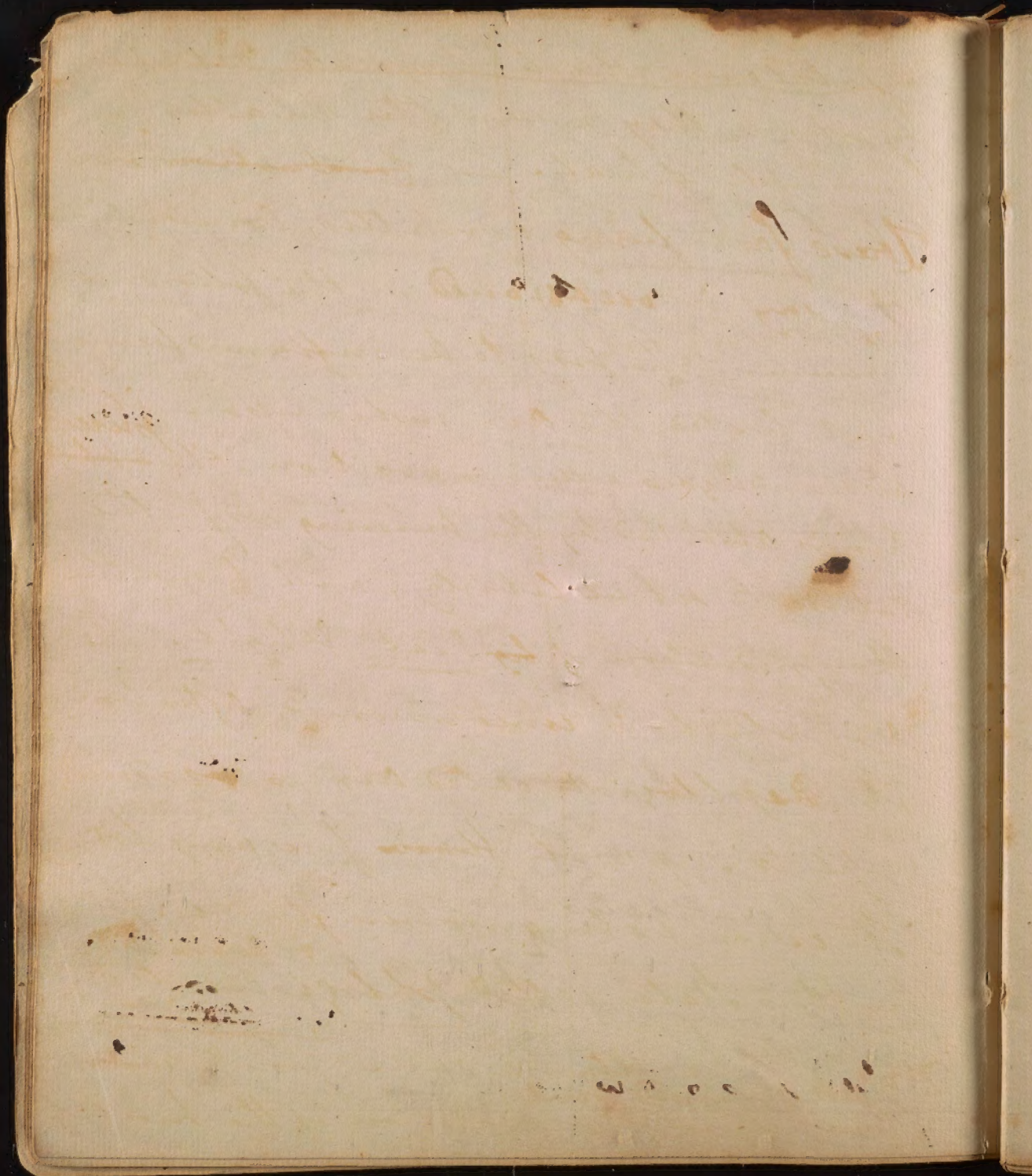
This phenomenon ~~was exp^d~~ was sup-
 posed for a long time to be occasioned
 by the discharge of a principle called
 Phlogiston, ~~and its~~ by means of the
 action of air upon it. This phlogiston

27th parts of ~~oxygen~~ oxygen, 72 of Acote
and ^{one} ~~two~~ of Carbonic gas. The oxygen
~~as from~~ ~~air~~ they say further is a
compound of pure air & a substance
which they call Caloric

is supposed to be ^{the 139} same in all bodies, &
transferable by certain chemical
processes from one body to another.

~~Some late~~ ^{the} experiments by Mr.
Lavoisier and other French Chemists
have called the existence of this Phlogis-
-ton in Question. They suppose, ~~as~~
~~rather, that they have proved~~ ^{they prove}, that the
principle which produces Combustion
does not reside in the burning body, but
in the Air which acts upon it. —

This Air they ~~now~~ say is a compound
body consisting ^{of} Atmospheric Air and
dephlogisticated Air - $\frac{1}{3}$ - or $\frac{1}{4}$ of the
latter, and $\frac{3}{4}$ or $\frac{2}{3}$ of the former, ^{with a}
small portion of carbonic gas ^{perhaps}
- The dephlogisticated Air they say ¹⁰⁰ fur-
-ther, is composed of ~~air~~ pure Air, and



140
a substance which ~~they~~ call caloric,
by which they mean the matter, or
principle of heat. — ~~Combustion they~~

These facts being admitted, Combustion
they say is occasioned in the following
manner. The body to be inflamed being
first heated, the air rushes upon it
and undergoes a decomposition. The ~~dephlog.~~ ^{pure}
air is absorbed by the burning body - the
caloric is set at liberty, and hence the
the production of big heat - & light. The
air which is unconsumed after losing
its dephlogisticated air is ~~rendered~~
unfit to support ~~flame~~ fire any longer.
- It even extinguishes flame. It is
in this state called phlogisticated &
~~it is supposed~~

Exactly the same process goes ~~on~~
Dr Black, supposed went
forward in the production of the heat of

more accurate exp^{ts} of ^{by} diffusion ⁴⁰
of ^{cubic inches} ~~of~~ ^{40 -} ~~of~~ ^{at} ~~of~~ ^{heat}
of ^{cubic inches} ~~60~~ ⁶⁰ - It ~~and~~ expands to ⁴³ in
the lungs.

+ It is 111° in birds who have & they
we know have large lungs in prop^{ty}
to 7° size. It is in a low degree in
fish - insects & reptiles ^{all of which have small lungs} ~~who~~ consume
but little air in respiration. It is
~~of~~ in a low degree in the toad - for W.
arson Mr. Trifp informs us in his travels
into Spain that the Spanish ladies sometimes
carry them in their ^{bosoms} ~~clothes~~ in order to open
the heat of their bodies in hot weather.

the human body. — we all carry a fire
~~it has been said~~ ^{it has been said} ~~about with us,~~ ^{and} The chimney
 which contains it is seated in the lungs.

The ^{which are adduced to} ~~many~~ facts ~~concur~~ ^{are as follows} to support this theory,

= 2 The Quantity of air consumed in respi-

ration - said to be a gallon in a minute.

14 cubic inches ^{according to Dr. Goodwin} in each
 of ^{inspiration.} ~~inspiration.~~ ^{but according to V} The absolute capacity of air to animal

life. — here bring in from p. 149 =

3 ^{Animal} ~~Animal~~ heat being in proportion to
 the Quantity of air ^{consumed} ~~consumed~~ in respi-

ration, & the fire of the lungs in proportion
 to other parts of the body. — +

4 The Change produced in the air ^{his} is
 discharged from the lungs being ex-
 actly the same as that which is produ-
 ced in air robbed of its ^{oxygen} ~~pure~~ or ~~dephlog-~~
~~gisticated~~ ^{oxygen} air, and caloric or matter of
 heat by the combustion of a body. The
 air we expire is true phlogisticated

arterial

✓ 6 From the ~~phlogisticated~~ ^{air} ~~is~~ ^{which} is
discharged from the lungs being
warmer ^{up} according to DeCandolle than pure
~~dephlogisticated~~ ^{oxygen} air which is taken
into the lungs.

7 From the arterial ~~degree~~ ^{acts} blood on
which the ~~dephlog.~~ ^{oxygen} air acts first, being
warmed by $1 + \frac{1}{2}$ (according to the same
author) than venous blood. ~~it is~~ ^{it}
as $11 - \frac{1}{2}$ to 10. — by Mr Hunter's and
thermometer it was 99 in the right ventricle in the
left Ventricle of a Dog hung for this purpose by
Mr Coleman.

or arose - 142
Air - it ~~can~~ extinguishes flame, and
is fatal to Animals. —

5 From the ^a effects Phenomenon^{ch} appears in the ~~lungs and~~ body after
the Action of ~~dephlog~~^{by oxygen} Air upon it. This
Air ~~changes~~ produces a red color in
many bodies with which it combines.
such as red lead: and Colcothar of
Vitreous ~~It~~ and Irons preserved with
Salt petre - for this Salt abounds with
dephlogisticated ^{or oxygen} Air. Now the red color
of the blood is supposed to be derived in
like manner from the action of this
Air upon it. It is certain it is much
redder in the pulmonary vein, than
in the pulmonary Artery, after the Air
has acted upon it. ~~and~~ redder in an
adult than in a fetus ^{ch} who has not breathed.

One

& I know of but ^{one} objection to this theory,
& that is the heat of a Phlegmon or of
any local inflamⁿ: at a distance from the
lungs. It appears in this instance to be
connected with the action of the vessels, &
to be wholly unconnected with respiration
or the entrance of ^{air} ~~into~~ Perhaps that in the

process of inflamⁿ: there may an exsiccation
or ~~by~~ a conversion of latent into sensible heat
of caloric from the air which I shall say
hereafter enters into the composition of
the blood. This is rendered the more proba-

: ble from the decomposition or new
Arrangement of ^{the} particles ^{of the blood} which takes place
in local inflamⁿ: - now the alteration.

the texture or consistency of bodies we know
in many cases evolves latent heat. Perhaps
~~then~~ The objections to this theory of
animal heat are the ~~old~~ action of air

From the analogous effects of ~~dephlog~~
 air upon a burning body, and upon the
 lungs. The more of this air that can
 be applied to a burning body, the more
 vivid its flame, & the greater its heat.
 its heat - In like manner, the more
 of this air that is received into the
 lungs: the ^{greater} ~~more rapid~~ the generation of
 heat; hence the increased heat of a
 the body after exercise - and in a fever.

It is a striking property in the
 heat of the human body; that it
 is the same in all climates & in all
 seasons ^{viz 96°} ~~a few exceptions in the west~~
 In many theories ~~the heat of the~~
~~human body is supposed to be accounted for it. Dr~~
 Crawford supposes that absolute heat

& phlogiston are two opposite prin-
 = ciples

Upon the blood part of the body imparts
no heat to it. That it acts upon it
we infer from its giving it a red color.

2 The heat of the body is but ^{parts} greater
in the lungs than in the remote ^{parts} of
from there - now were the lungs the
fire place in which heat was pro-
duced, there ^{it is said} would be a greater sensation
of it than in the extremities.

3 There is often a mottled coloring, or
burning in the extremities; now this
could not take place if heat were
generated only in the lungs, - for heat
would certainly follow its law of
a constant tendency to an equilibrium
in living as well as dead matter.

4 There is often great heat in inflamed
parts remote from the lungs. From

in nature, & that ~~is proportioned~~
 is added to any body, its capacity of contain-
 ing Absolute heat is diminished, &
 that when Phlogiston is abstracted from
 the same body, its capacity of receiving
 Absolute heat is augmented. hence the
 heat of the body is prevented from
 rising above ~~rising too high~~, or falling below
 its natural standard in summer &
 winter. — ^{This hypothesis in the inquiries} ~~But the discovery of the~~
 is overthrown by the discovery of
 the French Chemists which exclude
 Phlogiston from the human body,
 in common with other combustible
 matters. —

It is easy to conceive why the
 body will always maintain the

before
this, & the ~~2~~ arguments mentioned, it
would seem as if the generation of
heat was carried on at the same
time, and by the same means in
every part of the body. ^{see other objections}
to it, but pass w^d in D^r Hartshorn's Thesis p 22-23.

Let us ~~in~~ endeavour to account
for the production of animal heat by
the extension of Dr Black's theory. Let
us suppose the Oxygen rec^d into the
lungs to be decomposed there in part,
and that ~~it is~~ after mixing with the
blood, it is conveyed by it into every
part of the body, & decomposed by enter-
ing into Union with those parts w^{ch}
are formed or nourished by the blood.
Two ~~the~~ things favour this conjecture.
1 all bodies in passing from an aerial,
to a fluid, or from a fluid to a solid

same temperature in winter from
 the means which produce heating
 so exactly the same. But why does
 not the body rise with the heat of
 the air to 100° and even 120° & 130° ?
 It has been common to answer this question
 in summer? ~~I have~~ ^{by saying} - that
 the discharges by sweat from the
 body are always proportioned to the
 degrees of heat to which the body is
 exposed, - now evaporation whether
 of sweat, or water always produces
 cold - and this probably reduces
 the system to its natural standard
 of 96° . — ^Q

However provident nature may
 have been in maintaining a

heat. Now

form, emit a portion of it. The
Oxygen ^{ch} circulates with the blood
passes from ^{both} ~~fluids~~ ^{both} ~~air~~ ^{airial} and ~~an animal~~
a fluid form when it enters into
composition of those solid ^{fluid &} ~~bodies~~ ^{parts of} of
which the body of which it is ^{it is} ~~as~~

~~It is~~ ^{first} ~~is~~ ^{of the human body} ~~derived from our element,~~
as well as from the air.
appears from its being detected in

the human Calculus - Urine &
fat - in the form of the Lactic
Aid - ^{the acid of} phosphorus - & the acid of

fat - ~~from~~ ^{the oxygen} these acids are probably
derived from ~~the gas~~ ^{for its taken}
into the lungs - for its very name

implies that it is of an acid nature.
^{return to p. 143 & go to p. 144}
~~This opinion is not well supported by~~
~~as - acids.~~ ^{The fact of perspiration under}

~~acid~~ ^{the latter} ~~forming out a calculus.~~ ^{broth}
~~formed probably by the decomposition of the air and the tissue.~~
in nearly the same - They both tend

led
 transcribed to inquire whether the
 author of it has ^{made} left it to the sole operation
~~causes which I said produced these~~
 of the causes I have mentioned to produce
 at all times sufficient for that
 it, and whether there are no means
 proposed. - If they should not,
 appointed to obviate such obstructions
 there are other causes which occasi-
 on may occur from to its being performed in
 usually supply their absence, or
 in a regular and perfect manner? Certain
 deficiency. - These are the signs of

coughing - Sneezing - Yawning - Sighing
 panting - Hiccups -
 and laughing, & Crying. Each of w^{ch}.

I shall explain in order.

When the lungs become impacted by
 phlegm, - mucus, - or extraneous sub-
 stances received into them, by inspiration,
 the action of the Air upon them is im-
 peded, & the circulation of the blood
 thereby
 mechanically obstructed by the pressure



// of these ~~last~~ matters upon the blood
 In this case ^{take place}
 vessels, — ~~from~~ the action of constriction,
^{Coughing}
which is a convulsive motion attended
 with ^{a quick alternate} deep inspirations & expirations,
~~and~~ together with a concussion of the
 abdominal muscles, all ^{of which} ~~of which~~ con-
 -cur to expel the offending matters from
 the lungs, and to restore the circulation
 of the blood. — ~~The phenomena I have men-~~
~~tioned occur most frequently in~~
 the decline of life, and in cases of
 universal debility, ~~of the~~ hence
 the Supis Senilis or the Old man's
 cough which is so notorious that an
 old man is never but on the stage with-
 -out it — and hence too the original
 use of the cough in the pulmonary

✓ place from another part of the body.

consumption. Death would be the consequence of its suspension for a few days, unless a discharge took V

Sneezing consists of one deep & full inspiration followed by a sudden & violent ^{convulsive} expiration. It is intended to serve nearly the same purpose as coughing in the animal Economy, - viz to expel stagnating mucus &c & the like, from the lungs, and ~~also~~ the passages which lead to them thro' the nose. Sneezing is frequently a promonitory symptom of a Catarrh. - It occurs in the ~~present~~ debilitated state of the lungs which precedes the inflammation of the pul-
-monary vessels, ^{in that dis-~~ease~~ease,} and it never fails for a while to remove the mucus, ^{& other matters} ~~etc~~ which accumulate in the lungs in



consequence of the predisposing debility
of the Catarrh. — Smearing likewise
occurs about the crisis of certain
fevers, and is always a favourable
sign as it shows sensibility & excit-
: bility to be revived in the lungs, to
~~the organs~~

Yawning is attended with a full
& a gaping of the mouth.
It slow inspiration; the upper limbs
are often stretched out the same time.
It seems to accelerate the circulation
not only thro' the pulmonary vessels,
but thro' the veins which convey the
blood thro' the lungs into the left
Ventricle of the heart. It occurs ^{at} ~~in~~
those times when persons are ~~over~~ fatigued,
~~by labor of the body~~ - as in

V Panting urges the passage ~~thru~~^{of} the
~~thru~~^{thru} the lungs
blood by numerous quick and short
acts of inspiration & expiration. It
seems to ~~accelerate~~^{send} the blood more speedily
to the left Ventricle of the heart after
great exercise - also to propel the blood
thru the lungs when it is disposed
to stagnate or in certain diseases
of the breast. —

¶ Hence too the propriety of comic representa-
-tions being exhibited ^{only} in the evening. —

I shall say hereafter it has often per-
-formed great cures in certain diseases.

Q I remarked formerly that the Div
gave the first impulse to life in Adam when
his creator breathed into his lungs the breath
or breaths of life. ^{that} The same stimulus begins

late in the evening 47 26
~~the evening~~ ^{trifling}, or after attending to
a long, and ~~long~~ discourse. - It occurs
likewise in the ^{just after waking} evening when the
system is still in the debilitated and
languid state which is induced by
Sleep. V

= Laughter consists of many short
quick and imperfect acts of inspiration, &
expiration, by which means the agita-
tion of the lungs is much greater
than in ordinary respiration. When
moderate, it conduces to health. It is
most necessary in the evening - and
hence ~~the evening~~ ^{the evening} ~~the evening~~ has
been appropriated by wise men
every where to those festive pleasures
of which Laughter composes a part.

The actions of life in a new born child. The
Air rushes into ~~the~~ ^{its} lungs - its first impulse
gives pain - hence it cries - this adds to
the stimulus of the Air in setting the ma-
chine of life in motion - nor do the lungs
cease for years afterwards to be the bellows
of life - hence

✓ the debility of grief, or the depression of joy,
hence the relief persons who are under the influ-
ence of either of these, feel from the shedding
of tears. —

tion in imparting motion to every other
part of the body, until by repetition
they ~~become~~ ^{are} so associated with the action
of Respiration as to become habitual.
The necessity of all these artificial or morbid
train over ==

Hiccup is a violent ~~deep~~ ^{and} ~~convulsive~~ ^{and sudden} inspiration attended with a noise. — It occurs frequently after ~~the debility induced~~ ^{immoderate} laughter, and serves to remove the ~~debility~~ ^{debility} which is induced by it. It occurs likewise in the lowest stages of certain fevers, ~~from debility~~ ^{immoderate}.

Crying is attended first with a deep inspiration, — then a number of short alternate acts of inspiration & expiration — afterwards with one deep expiration, and one large inspiration.

— It is wisely & kindly intended to remove the languor in the circulation of the blood in the lungs which is induced by

thus we see pain, ~~pleasure~~ pleasure in this
disposed to cry before they laugh. They
as in ~~other instances~~ shed tears in crying in infancy.
~~some degree of~~ The mind must concur to produce the
secretion & discharge of tears. Their first
acts of laughter are without noise.

of which

eye back to p 177

Hermit of Engaddi

V I shall pass over ~~a description~~
~~I must inform you that~~
of the Anatomical structure of the
parts which are employed in both
these exercises you will receive
it with more advantage from the
Anatomical Chair. — go to p: 181 x

~~— Lids to Respiration is wident from its
being so disposed to cease when children sleep
upon very soft beds, or sleep without rocking.~~

From the closure of Stimulus they the
blood stagnates in their lungs, & hence
they start - and instantly scream, or cry,
& thus restore the circulation of the
blood in their lungs, and ~~at~~ with it
all the functions of life. - go back to
p 179 #

Introduce this subject first by describing
 the structure of the trachea and larynx
^{glottis}
~~the together with the pharynx - tongue -~~
 nose and lips. I would ^{in a more} ~~mention~~ the
~~that~~ especially manner dwell upon
 the cartilages ~~the muscles and the liga-~~
~~ments which compose the larynx.~~
 I would fill your ears with the ^{high} ~~most~~
 sounding terms of its thyroid - cricoid -
 tracheo - arytenoid cartilages with its
 epiglottis - I would describe each of
 the ligaments which connect these car-
 tilages together, and then proceed to
 mention the muscles which move them,
 such as the Sternothyroides - Hyo-
 -thyroides - Crico-arytenoides ~~post.~~
 -icius - Crico-arytenoides lateralis.



Thyro-Arytaenoides - Thyro-epiglottides
 - Arytaenoides obliquus & Arytaeno-
 Epiglottides. But Gent: I am willing
 to give up ~~off~~ the ^{learned} character I should
 acquire by such descriptions, and
 shall content myself with the humble
 satisfaction of having aimed to teach
 you such things only as are useful
 and intimately connected with ^{the knowledge of} the profession
 of Physic. ~~I conceive Physiology to be~~
 to Anatomy, what Philosophy is to
 Natural history. - They both suppose
 the objects on which they treat to be
 discovered and known - and the business
 of ~~the latter~~ ^{the latter} former as much as the latter is only
 of ~~unfolding~~ ^{unfolding} ~~the~~ ^{the} unfolded prin-
 ciples

V I shall only remark here that by spending a principal part of my course in these ~~minutes~~ ^{disquisitions} but ~~particular~~ anatomical descriptions, I should save myself the labor of much thinking, & the deliver myself from the necessity of deciding on many controversies, on w^{ch} I would have preferred a prudent silence or neutrality. -

By voice I mean sound emitted from the ~~very~~ mouth whether in hallowing - singing - laughing - or speech.. By sound I mean certain tremors or vibrations of solid bodies excited by ~~the~~ inspiration made upon them by other bodies, and which are afterwards communicated ^{to the ear} by the medium of the air. To this acc^t of sound there is the exception of sound being conveyed to deaf people thro' the medium of wood - and several metals. -

¶ ~~It is still more clear~~ The frontal - Ethmoid & maxillary sinuses afford some aid to the voice of a similar nature.

It to explain the laws and operations
which govern the ~~of the~~ world ✓

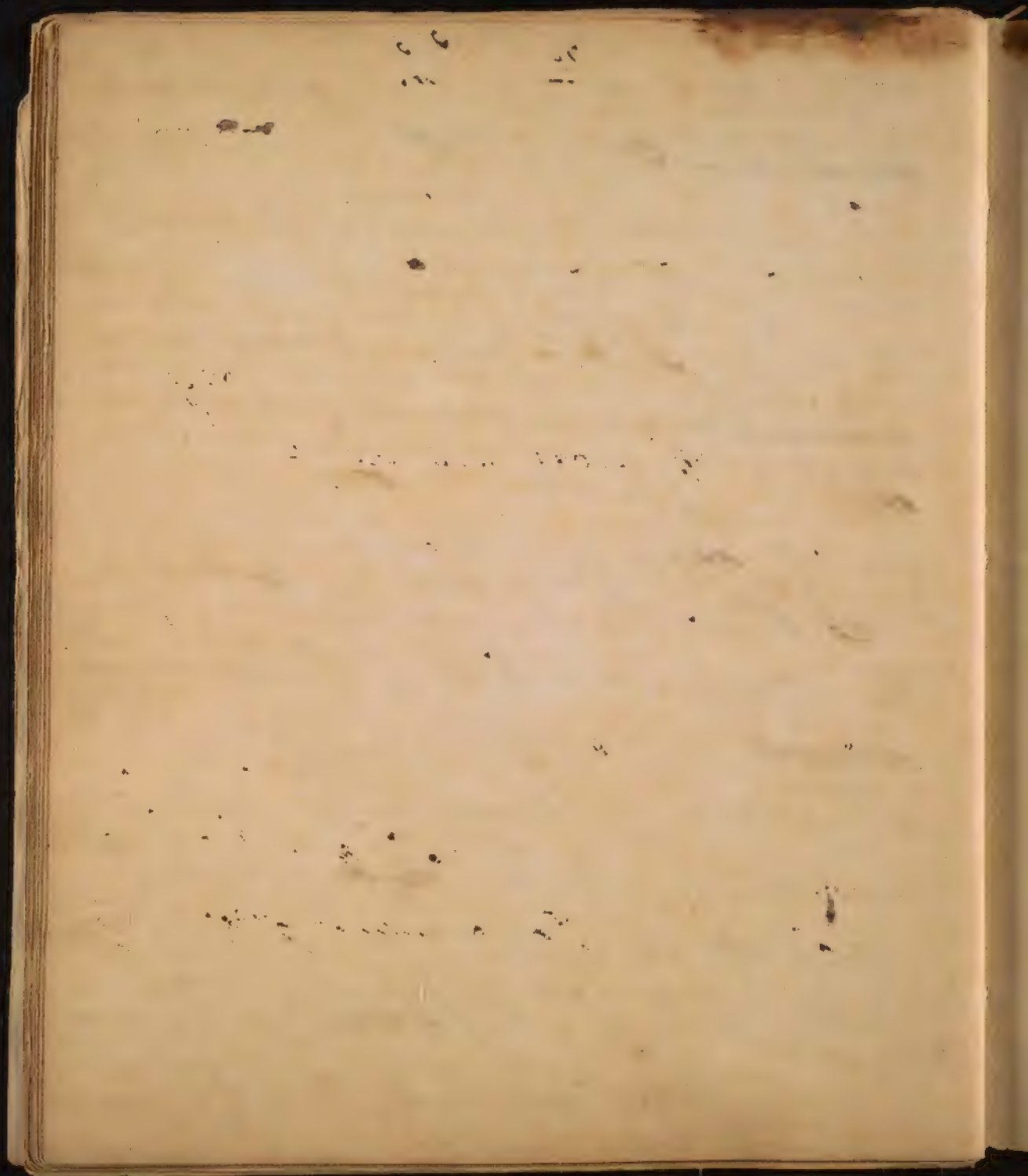
The parts which are employed in ^{chiefly}
forming the voice are the trachea &
the Larynx ~~and Glottis~~. I say nothing of Epiglottis - as
it only closes ^{the} Glottis in eating & drinking. The Voice ~~is~~
~~is increased in its strength & rendered more clear & agreeable by~~
~~its passage thro' the~~ ~~mouth~~ and

mouth. ~~These~~ perform ~~the~~ ~~office~~ ~~of~~ the sounding board of a pulpit. ~~†~~ ~~†~~ ~~†~~

Physiologists have been divided in
their opinions whether the ~~structure~~ ^{forming}
~~of~~ the organs employed in ^{the}
the voice

resembles a wind - or a chorded instru-
ment - or whether ^{they are} ~~the~~ compound

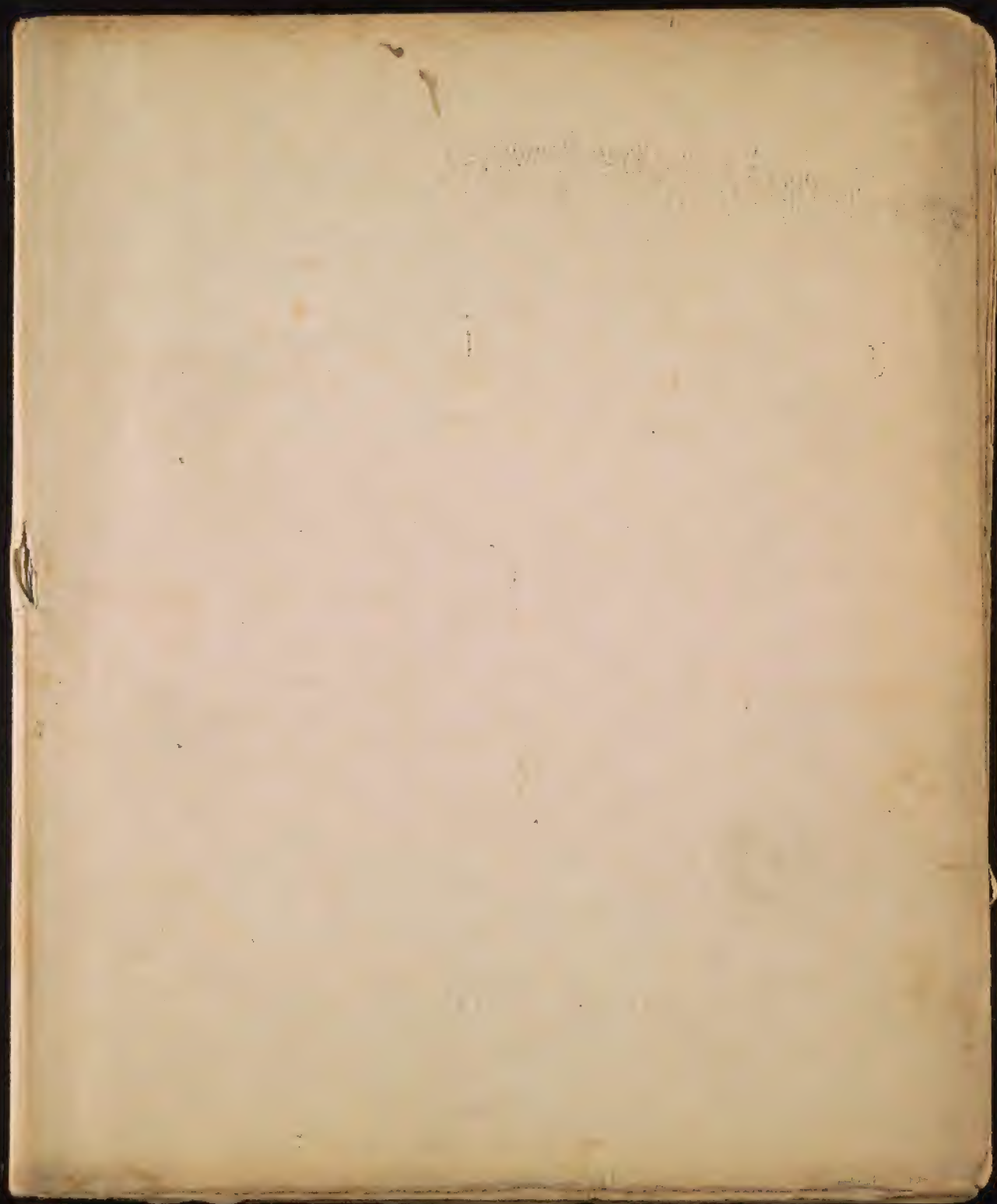
upon the compound principles of
both of them. The ~~last~~ last opinion
is the most general one [It was]



~~But I am~~ ¹⁸³ But I am ~~inclined~~
~~to doubt it, and to~~ ~~strongly~~ incli-
ned to believe that ~~the~~ the Voice
is produced ~~exactly~~ exactly in the
same way that sound is produced by
a wind instrument. > My reasons
for this Opinions are as follow.

1 The Strings of a corded instrument
of music, for example a Violin, when
stretched to a that degree as to be tuned;
always emits a sound when struck
by the bow - but the sides of the glottis
~~and~~ which are supposed to be most
analogous to the cords of a Violin
when stretched to their highest degree
of tension, and afterwards struck ~~by~~
by a solid body emit no sound, nor











1
we come next in order to treat of

Respiration

I remarked formerly that it was at first altogether involuntary, and that it became both voluntary & involuntary from habit. In consequence of this change it may be accelerated or retarded and even suspended for a while at our pleasure, but in general it goes on as at birth in an involuntary manner without any consciousness, or act of the will. Now ~~is~~ it is performed? What are its causes, and what are its uses in the Animal Economy? - I shall attempt in the present



Lectures, to answer each of these questions.

Respiration consists of two parts, viz Inspiration & expiration. For a description of each of them I shall refer you to books particularly to Dr Cullen's little tract upon Physiology. I shall only make ~~briefly~~ a few remarks upon the lungs.

- 1 In proportion to their Utility & necessity to the health & life of Animals, they are removed at a distance from sight & from injuries.
- 2 They contain according to Mr Cruikshank the greatest number of Lymphatics next to the liver of any Viscus in the body & for wise purposes to be mentioned hereafter. They are seen most readily by inflating the lungs of a new born infant



with
Air.

3. The pulmonary Artery is supposed to
convey ~~oxygen~~ nourishment to the lungs.
Dr Haughton infers this from ~~the~~ in-
jections passing from it to the membranes
which is formed upon the lungs, and
which becomes vascular by inflam-
-mation.

4. The ~~lungs~~ ^{lungs} possess but a small portion
of nerves in proportion to their quantity
of matter. They consist of the Anterior
and posterior pulmonary nerves, and of
some small branches from the recurrent
nerve, and of the Cardiac plexus which
enter together with the blood vessels. ~~It~~
- hence the lungs possess but little



4

Sensibility, and ~~but~~ not as much irritability as ~~was~~ ~~been~~ formerly supposed. Their most sensible part is ~~at~~ the Bronchia. Many facts concur to prove the lungs to be endowed with but little Sensibility and irritability. These are 1st Wounds, inflammation, ~~deep seated~~, deep seated Abscesses, Ulcers, and even water and tubercles existing in the lungs without exciting any pain.

2 D'Arsonne has proved by many experiments ~~that~~ upon the lungs of living animals, that they possess but little Sensibility. I know it may be said that these experiments are not conclusive, inasmuch as the ~~lungs~~ ^{lungs, of} ~~the~~ ^{same} animal while under the



torturing knife of an Anatomist, may
 have its sensibility so far engrossed on
 suffocated by pain as to discover no
 marks of it in ~~excitation~~ Sensation
 or motion. It has been said further
 that parts which discover but little
 sensibility or irritability in health,
 show signs of both when diseased. This
 is true, but the remark does not apply
 to the question before us, for I am
 now considering the physiology of the
 lungs only in their healthy state in
 which case they are possessed of but
 little sensibility or irritability. This insen-
 -sibility and want of exquisite irritability
 are wisely and kindly given to the lungs



in order to defend them and the whole
 body as far as it is dependant upon
 them for health, from many diseases,
 particularly from ^{those which arise from} the innumerable
 particles of irritating matters which
 float in the Air - from the extremes
 of ~~heat~~ ^{heat} and ~~cold~~ ^{cold} ~~of moisture~~ ^{of moisture}
 and dryness. ~~and dryness~~ - from particles
 of food and drink which escape in
 swallowing into the trachea thro' the
 Glottis, from loud and long speaking
 and singing, and from the effects of
 contusions, and other acts of violence
 to which they are constantly exposed.
 Were the lungs otherwise formed, ~~as~~
~~they~~ they would probably be the
 principal Avenue of disease & death.



~~But I have said the lungs & the heart~~

✓ I have said the lungs & the heart but a small
portion of nerves in proportion to their
size, - hence they are life dependant upon
the brain than several ^{other} of the viscera.
This is obvious from their ^{often} performing
their office in an easy & natural ~~when~~
manner, when every other part of the
body is disorganised, & in the grasp of
death - nay more when the brain itself is
in most diseased state - state further, when
the brain & head are removed from the body.
This has been lately proved in France &
by Dr Brodie in Great Britain. After
cutting off the head of a dog, he kept
him alive two hours & 1/2 by inflating

9
Sources of diseases that have been men-
-tioned. In youth & middle life the
proportions of sensibility & irritability
in the lungs is nearly ~~the~~ equal, but
in old age, the latter predominates over
the former, and for the same reason
that were given for its excess in infancy
and childhood. ~~at~~ ✓

4 Those parts of the lungs which are
exposed to the air including the trachea,
and the minute branches of the Bronchia
are said to be equal to the whole surface
of the body.

5 No two persons have exactly the same
number of inspirations & expirations
in a minute.

6 There are generally three or four

his lungs with a pair of bellows. //

9
Strokes of the radial Artery to one ^{complete} ~~complete~~
Act of respiration - but this proportion
varies in different people. It is moreover
varied by disease. It is likewise different
in different Animals.

7 There is a greater dilation ^{th.} of the Thorax
in ~~inspiration~~ inspiration in Women, than
in Men - for the wise purpose of fa-
-cilitating gestation. It ~~appears~~ ^{appears} in the
infancy & childhood of the female sex.

Causes ~~Causes~~ We proceed next to inquire into the
Causes of Respiration. These are

1 An Uneasiness in the breast which is felt
after every Act of inspiration & expiration,
that stimulates to a repetition of the same
Actions. In expiration the lungs are
compressed, and the blood retarded in
its passage from the right Ventricle.

thus admitted into the lungs,
V this fluid, ~~many~~ important
Advantages are derived in the Animal
Economy. | It serves //



11

Sensation and thought were first excited
by it in our progenitor Adam, and that
it gave the first impulse to life in all
the children that came into the world.

The Air
2 ~~Respiration is the process~~ which is
taken into the lungs ^{is, thereby} ~~decomposed~~
& becomes ~~one of the causes of~~
animal heat.

3 ~~It imparts by its oxygen a red~~
color to the blood.

4 ~~Respiration~~ A certain portion of it
is probably mixed with the blood. I say
a certain portion only, for an undue
quantity induces disease & death. Dr. B.
-that injected a quantity of air into the
lungs of a dog, and then tied up the trachea.
The dog became agitated: He then opened



One of the Arteries of his leg from which
 a number of Air bubbles ^{if used} mixed with
 blood. He ~~performed~~ ^{performed} the same experiment
 with Hydrogen gas. The Gas took fire
 when discharged from the leg of the
 dog. Dr Hartshorn injected Air into the
 femoral Artery of the dog. It did him
 no injury. He injected it gradually.

Take notice of these facts. I shall here-
 -after mention some others which
 show Air to be present at all times
 in a qualified state in our blood, and
 I shall I hope explain the Cause of
 several Diseases from it. Take notice
^{further that} Dr Hartshorn ~~having~~ injected the
 Air gradually into the femoral Artery
 of the dog. Many Stimuli applied both



internally & externally in a gradual manner are inactive ~~and~~ inoffensive, which produce disease & death when applied suddenly. The Air when received into the blood probably parts of some of its natural properties while the body is in health, but resumes them in disease. So necessary does a portion of it seem to be in the blood, that it is thought to be conveyed into it from other sources when its ^{natural} passage to it is obstructed by a disease in the lungs. This is made highly probable by ~~the~~ ^{an} experiments made by Dr Beddoes. He injected a quantity of Atmospheric Air into the cellular membrane of a dog, and found it completely absorbed in the course of 20 days. He afterwards injected Oxygen

✓ I have only to add under this head,
the lower & weaker the circulation of
the blood, the less air is required for
the purpose of Respiration. A dog that
was bled until the pulsation of his Artery
was imperceptible, lived four minutes
½ under water, while another dog in
good health, lived ^{only} ~~more~~ two minutes
in the same element.

into the cellular membrane which was instantly absorbed & produced great activity in the Animal.

5th Lastly Air in its oxygenous state is received into the lungs by means of respiration in order to impart irritability to the muscular fibres in every part of the body. The heart & Arteries beat but 60. in a minute in a fetus in Utero, but it beats 120 strokes in the same time as soon as it inhales Air into its lungs. I do ^{not} say that the irritability of the muscular fibres is derived exclusively from the Oxygen taken in by the lungs. It is likewise derived from our Aliments & Drinks. ✓

A 2nd use of Respiration is to convey a



a certain portion of moisture which is absorbed by the Lymphatics of the lungs in order to mix it with the blood for certain necessary purposes in the Animal Economy.

3 Respiration serves to convey out of the body thro' the Channel of the lungs, certain matters which are of an offensive nature to the System. These matters are Azotic air, commonly called nitrogen, & Carbonic Acid & water. This water has been supposed to be formed by the Union of Hydrogen & Oxygen in the lungs, but several facts render this improbable. 3xx ounces & $\frac{1}{4}$ of an ounce of water according to Dr Hales are discharged from the lungs in the course of 24 hours, which are $\frac{4}{5}$ th more than is ~~is~~ absorbed by



them in the same time. The Quantity & Quality of the matters discharged from the lungs are much influenced by the Quality and Quantity of Drinks taken into the body, also by ^{climate} Season, Age & exercise. The matters discharged from the lungs in expiration have been the Subjects of many experiments. It extinguishes flame & is fatal to Animals. It is specifically lighter than common Air - hence a Candle is ^{sooner} ~~extinguished~~ extinguished, and an Animal dies ^{sooner} ~~sooner~~ in the upper ^{than in the lower} part of the Vessel that contains it. Young Animals, particularly Mice live longer in it than such as are full grown. Take notice of this fact. I shall apply it hereafter in speaking of the Signs of Life



and death in Children. Further, an animal
lives longer in ~~any~~ ^{this} air when it gradually
phlogisticates it, than when it is suddenly
exposed to it. This fact will admit of an
extensive application when we come to
treat of the effects of miasmata upon the
human body. Animals die in the air
or matters which are discharged from
the lungs. ~~in a shorter time~~ ^{consulted}. They live
five times as long in oxygen, as in
common atmosphere, and when they die
in it, they suffer much less pain than
when they die in air that has been
respired, that is, in azotic or phlogisti-
cated air.

I have said there are three or four
pulsations of the artery at the wrist,
to one act of Respiration. This shows of
respiration compared with the frequency
of the pulse is happily calculated to give

8.
It is required for the purpose of Respi-
-ration. A dog that was bled until
the pulsation of his Arteries was
imperceptible, lived four minutes
& 1/2 under water, while another
dog in good health lived, but two
minutes in the same element.

If the Uses of Respiration are so
unimpaired & important, we are
naturally led to inquire, whether our
maker has left it to the sole operation
of the Causes that have been mentioned,
to produce it, and whether there ^{are} any means
^{appointed} to obviate such obstructions as may
occur to its being performed in a regular
manner. ~~Answer~~

the Arterial Air which is discharged from
the lungs time to rise (which it does
from being specifically lighter than
Common Air) so far above ~~to pass~~
above the mouth & nose as to prevent thin
being inhaled into the lungs. I have
said that ^{a portion of} Carbonic Acid is exhaled from
the lungs with Arterial or Nitrogen. Per-
haps this acid is intended to defend the
breath from the fætor which Arterial or
Nitrogen possesses in a simple state, &
perhaps a fætid breath is caused by the
absence of this Carbonic acid Gas from
the matters discharged in Respiration.

I have only to add upon this ^{part of my} sub-
ject, that the lower and weaker the
circulation of the blood, the less Air

19

V It moreover excites a flux & reflux
in the blood, so that it is Alternately
prepared towards the extremities of the
limbs, and afterwards propelled towards
the heart with additional force, as into
an empty space. It is remarkable,
Respiration is performed with the
most force (tho' not frequency) in sleep,
when the Circulation of the blood stands
in most need of it from the Abstraction
of so many of the other Stimuli which
support life. This force is so great in
some people as to be accompanied with
the emission of Sound from the lungs
called Snooring.